

Electric Vehicles 101

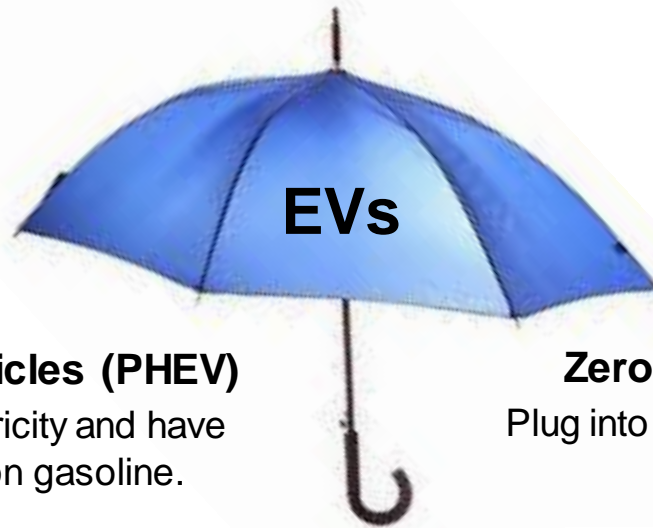
Starting to roadmap the coming electric vehicle future –
navigating challenges and opportunities

Overview

- ▶ This presentation is intended to provide a high level overview of electric vehicles (EVs) including:
 - EV types and characteristics
 - EV charging
 - Current EV efforts in DE
 - Utility run EV programs in other states
 - Challenges and opportunities of EV growth
 - The intersection of EVs and EE

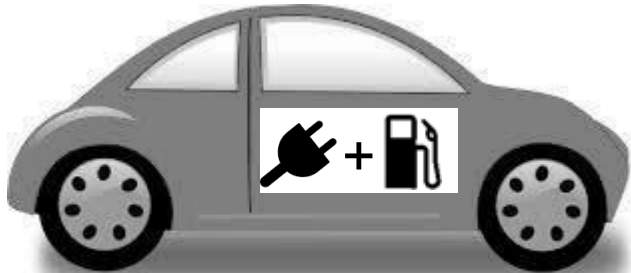
What are Electric Vehicles?

- ▶ Electric vehicles (EVs) use one or more electric motors for propulsion
- ▶ Different types of vehicles fall under the EV umbrella



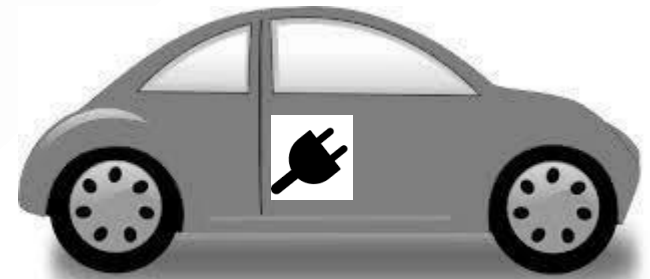
Plug-in Hybrid Electric Vehicles (PHEV)

Plug into to the grid to run on electricity and have internal combustion engine to run on gasoline.



Zero Emissions Vehicles (ZEV)

Plug into to the grid to run on electricity only.



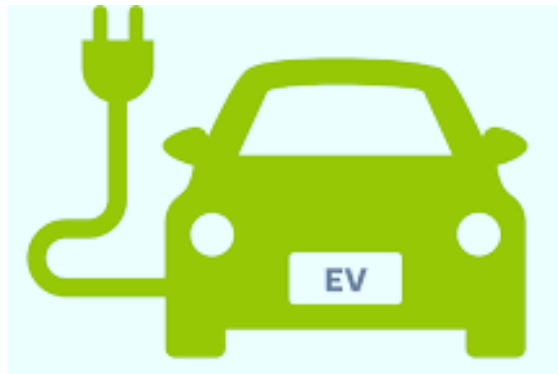
Electric Vehicle Capacity

- ▶ Distance range for ZEVs running only on electricity is 80-100 miles
 - Up to 250 miles for some models (Tesla; Bolt)
- ▶ PHEVS use electricity for shorter trips (6-40 miles) and gasoline powered internal combustion engines when battery runs out
- ▶ Charging an EV through the electric grid takes 30 minutes to a full day depending on they type of battery and charger



Electric Vehicle Charging

- ▶ EVs get energy from the electric grid through Electric Vehicle Supply Equipment (EVSE), also referred to as EV chargers
- ▶ There are 2 main types of EV chargers:
 - Alternating current (AC)
 - Direct current (DC), or “fast chargers”
- ▶ EV owners have several options for charging their cars
 - At home (many owners do most of their charging here)
 - At workplaces (if provided by employer)
 - At public charging stations (if provided by cities, states, and/or businesses)



Electric Vehicle Charging Cont.

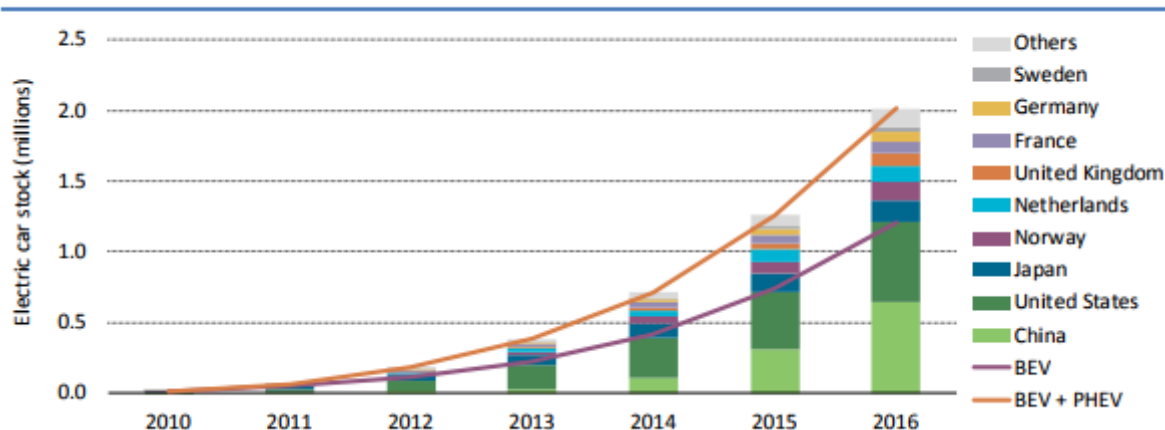
- ▶ AC current chargers further categorized by level, based on the maximum power the charger provides to the battery from the grid

Type	Application	Charge Time
AC Level 1 (120 volt)	Household, workplace	2-5 miles of range/hour of charge
AC Level 2 (240 volt)	Household, workplace, public	10-20 miles of range/hour of charge
DC (480 volt)	Workplace, commercial, public	60-80 miles of range/20 min charge

EVs -- future growth & sales

- ▶ EV deployment in the U.S. and worldwide has grown in recent years
 - In 2016, there were over 550,000 EVs on the road in the U.S.*
 - Conservative estimate of 1 million by 2025; high estimate of 3 million
 - By early 2020's, most car manufacturers will have ramped up EV production significantly
 - Volvo plans to produce ONLY EV/hybrids by 2019
 - Audi – commitment to over 30% of sales will be electric by 2025
 - Tesla's market value is same as GM and much higher than Ford

Figure 1 • Evolution of the global electric car stock, 2010-16



EVs in Delaware



- ▶ DNREC currently offers programs to promote EVs in DE
 - The DE Electric Vehicle Charging Equipment Rebate program provides incentives for the purchasing Level 2 EV chargers
 - The DE Clean Vehicle Rebate program provides incentives for purchasing or leasing new alternative fuel vehicles

- ▶ Delmarva
 - PSC proposal for six service offerings to support plug-in vehicle charging filed in October, covering single and multifamily properties and public places

Utilities in Several States Offer EV Programs

► Incentives for:

- Vehicles
- Charging stations

Table 4 | Incentives Offered by Utilities for EVs and Charging Stations*

Current Utility Incentives	Residential Charging Stations	Commercial Charging Stations	Vehicle
Alabama Power		\$500	\$750
Austin Energy ⁵⁵	\$1,500		
Central Maine Power		\$2,500	
Georgia Power	\$250	\$500/\$10,000	
Glendale Water & Power ⁵⁶	\$200		
Great River Energy ⁵⁷	\$500		
Indiana-Michigan Power ⁵⁸	\$2,500		
Jacksonville Energy Authority (JEA)		Free and up to \$7,500 installation costs	\$500/\$1,000
Lansing Board of Water and Light ⁵⁹	\$1,000		
Los Angeles Dept. of Water and Power (LADWP)	\$750	\$750/\$1,000/\$15,000	
Northern Indiana Public Service Company (NIPSCO)	\$1,650	Free Level 2 \$3,000/\$37,500	
NV Energy		\$30,000 (DCFC)	
Orlando Utilities Commission (OUC)		\$500	
PECO ⁶⁰	\$50		
Puget Sound Energy	\$500		
San Miguel Power Authority ⁶¹			\$250/\$750
Expired Incentives			
Central Maine Power		\$2,500	
Consumers Energy	\$2,500		
NV Energy		\$5,000-\$7,000	

*http://www.swenergy.org/data/sites/1/media/documents/publications/documents/How_Leading_Utillities_Are_Embracing_EVs_Feb-2016.pdf

Challenges from EV Growth

- ▶ Increased EV penetration will add load for electric utilities
- ▶ Without clear strategy, increased usage from EVs could result in:
 - Increased peak demand
 - Need to upgrade distribution infrastructure
 - Higher cost of delivered electricity



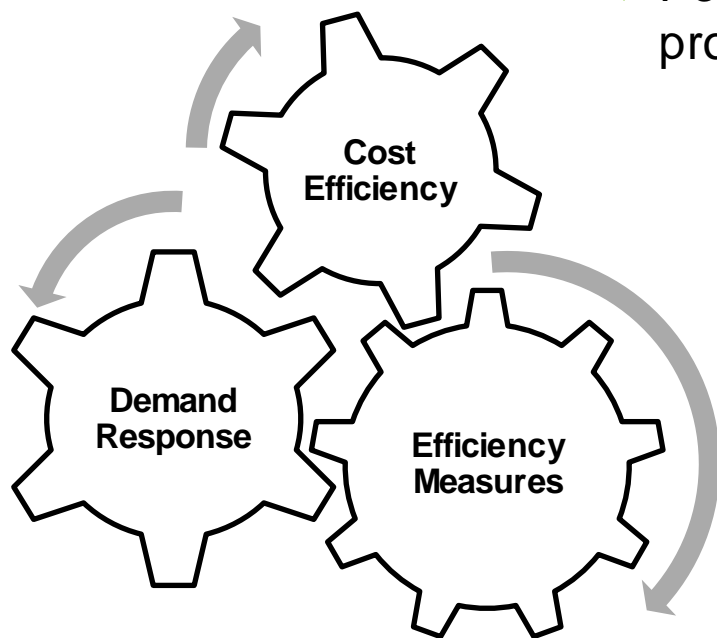
Opportunities from EV Growth

► With effective planning and coordination, EVs can serve as an important load-management resource to support:

- Demand response
- Battery storage
- Integration of renewables into the grid
- Grid modernization
- Greenhouse gas emissions reduction



Intersection with Energy Efficiency Programs



- ▶ Potential economies of scale from EV and EE program integration
 - Opportunities for co-funding
 - Lead Generation
 - EV approximately the equivalent of adding 1/3 to a house's electric load (3,000 kwh/year)
 - ▶ Level 2 chargers shown to be more efficient than Level 1*
 - ▶ More efficient charging stations could be offered as EE measures
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- ▶ Demand Response programs could communicate with EVs or charging stations

Other Considerations

- ▶ Time varying rates / Time-of-use (TOU) rates
 - May provide a valuable strategy to utilizing electric vehicles for load management
 - TOU pricing means that some portion of the electric rate is dependent on time of day/day of week
 - TOU rates send price signals to customers during times of peak usage and encourage them to shift charging to non-peak hours of the day



Thank You

Questions?

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